Torrance Refining Company LLC
3700 W. 190th Street
Torrance, CA 90504
www.torrancerefinery.com

VIA EMAIL

January 31, 2019

Dr. William A. Burke, Chairman
Vice Chairman Dr. Clarke E. Parker, Sr., Vice Chairman
Ben Benoit, Member
Joe Buscaino, Member
Michael A. Cacciotti, Member
Janice Hahn, Member
Dr. Joseph K. Lyou, Member
Larry McCallon, Member
Judith Mitchell, Member
Shawn Nelson, Member
V. Manuel Perez, Member
Dwight Robinson, Member
Janice Rutherford, Member

Re: Goldfish Tests and Water Mitigation, Refinery Committee Meeting, September 22, 2018 and Governing Board Meeting, February 1, 2019

Dear South Coast Air Quality Board Members:

During the South Coast Air Quality Management District (SCAQMD) fourth Refinery Committee meeting in Wilmington, CA on September 22, 2018, regarding Proposed Rule (PR) 1410, and in SCAQMD's staff presentation, Agenda Item #25 "Proposed Approach to Address Hydrogen Fluoride Storage and Use at Petroleum Refineries," for the February 1, 2019 Governing Board meeting, there was and is data being presented on historic hydrofluoric acid (HF) and water mitigation testing.

The Torrance Refining Company LLC (TORC), one of only two companies being targeted by PR 1410, is concerned that this topic is being narrowly presented and taken out of context. Therefore, TORC is submitting the following comments for the PR 1410 record to provide additional clarifying information on the extensive HF water mitigation testing performed, much of which was unfortunately excluded at the September 22, 2018 meeting and in SCAQMD staff's February 1, 2019 presentation.

TORC is concerned that SCAQMD staff and their consultants placed significant emphasis on the hazards of HF during the September 22, 2018 meeting, and now in the February 1, 2019 presentation, without including a balanced discussion of mitigation measures and associated testing. The complete story of testing and resulting improvements in mitigation systems is key to a comprehensive understanding of potential hazards and benefits associated with risk mitigation.

HF, MHF, and Water Mitigation Testing Summary

The total body of experimental work dedicated to proving the effectiveness of HF and modified HF (MHF) mitigation systems, including water, are substantial. Three key studies are listed below with the corresponding number of tests performed for each:

1. Goldfish Tests – **1986**
    a. HF – **3 Tests**
    b. HF with Simple Water Sprays – **3 Tests**

2. Hawk Tests – **1988**
    a. Large Scale Field Tests of HF with Designed Water Sprays – **87 Tests**

3. Modified HF (MHF) Testing – **1991-1995**
    a. PARC/Quest/Paulsboro Large and Small Scale – **186 Tests**

Details regarding each of the three testing regimes are provided below.

1. Goldfish Tests

During the September 22, 2018 Refinery Committee meeting, SCAQMD consultant Ronald Koopman focused his presentation on the first set of HF tests performed, known as the Goldfish tests.

As background, this initial set of tests was designed to show how HF behaved when released into the atmosphere. The tests were voluntarily conducted by industry, including Amoco, Allied-Signal, and DuPont in conjunction with the Lawrence Livermore National Laboratory, where Dr. Koopman was employed at the time.

The Goldfish tests were performed in the Nevada desert to ensure dry weather conditions and without barriers that could block the HF release. Six tests were conducted that showed HF formed a dense cloud containing aerosol, which traveled a distance downwind from the release point at ground level. Three tests involved no water mitigation and three tests included simple water sprays to determine if water could be effective in mitigating HF.

The water testing showed that applying water to a HF release lowered the amount of HF that became airborne and had the potential to mitigate a HF release. ***Researchers concluded that further studies were necessary to determine how water systems should be designed for optimal efficiency to mitigate a HF release.***

The encouraging water mitigation results from the Goldfish tests facilitated the subsequent formation of an extended consortium of twenty energy and chemical companies, which led to the creation of a

program to improve dispersion models and collect data on mitigation of HF releases. This next series of tests became known as the Hawk tests.[1]

2. Hawk Tests

The Hawk tests are a series of 87 experiments that studied the effect of water on HF releases. The Hawk series showed that water is very effective in reducing airborne HF at all ratios of water to HF. Specifically, water spray systems that have a ratio of 40 parts water to 1 part HF were documented to reduce the concentration of HF in the air by up to 90 percent.[2] These results were then used by industry to design water mitigation systems that have been widely implemented and are in use worldwide today.

During and after the September 22 meeting, SCAQMD staff questioned the effect of water mitigation and stated that a ratio of 40 parts water to 1 part HF is insufficient. This appears to also be implied in staff's February 1, 2019 presentation. However, staff has not provided to date any data, other than opinion and speculation, to support this claim. Contrary to staff's claims, published papers contain data that support a design basis for mitigation systems at a 40/1 ratio to effectively and efficiently address large and small HF releases.[3] [4] [5]

3. Modified HF (MHF) Testing

On September 22, SCAQMD consultant John Cornwell discussed some of the initial testing that Quest, the company he worked for at the time, performed on MHF on behalf of Mobil and Phillips in the early 1990s. The MHF tests aimed to identify a way to alter a HF mixture by adding an additional component that would reduce its potential to form a vapor cloud. **Mr. Cornwell discussed the testing that Quest was involved in, but was unable to describe the full breadth of testing performed by Mobil and Phillips that were further performed to prove the efficacy of MHF because, as he stated during the September 22, 2018 meeting, he did not have access to the later testing.** Unfortunately, in response to a question during that meeting regarding the efficacy of MHF based on current MHF additive concentrations in the two refineries Alkylation Units, he speculated on a potential lower efficacy, without full testing information.[6] Staff also unfortunately appears to have continued this speculation in its February 1, 2019 presentation.

---

[1] 1. Seringer, Carolyn S., Du Pont Chemicals, comments from technical review of Hydrogen *Fluoride Study, Report to Congress,* Draft May 8, 1992, June 5, 1992. (436.4)
[2] *HF Mitigation Water Spray Project, created for a meeting of the API and given to the U.S. EPA, December 10, 1991. (424.34ABC)*
[3] *Ibid.*
[4] Water spray mitigation of hydrofluoric acid releases, K.W. Schatz and R.P. Koopman, J. Loss prev. Process Ind., 1990, Vol 2 April
[5] *Ibid., (Prevention and Control of Accidental Releases and Hazardous Gases - Chapter 11, "Mitigation of Hydrogen Fluoride Aerosol Clouds with Water Sprays," Schatz, KW & Fthenakis, Vasilis, p 266-334)*
[6] *During his September 22, presentation, in response to a similar question, Dr. Koopman also speculated despite admitting he had not seen all of the MHF testing data.*

Mr. Cornwell and District staff failed to mention at the September 22, 2018 meeting and in the February 1, 2019 presentation that Quest's 1996 Hazards Analysis for the SCAQMD's permitting of the Torrance Refinery's MHF Alkylation Unit as part of its California Environmental Quality Act analysis, which was authored by Mr. Cornwell, states the following regarding MHF:[7]

> "Quest has been active since 1991 in the modified hydrofluoric acid (MHF) project that Mobil Research and Development Corporation (MRDC) has undertaken. Quest performed MRDC's large-scale outdoor testing work that was completed in 1993. During the course of the testing, we measured the release behavior of anhydrous hydrofluoric acid; hydrofluoric acid with additive; and additive alone."
>
> "During the experimental testing, we observed that the addition of Mobil additive to HF was an effective method of reducing or eliminating the amount of aerosol formed during a release …"
>
> "The additive also has an obvious – dilution of the HF concentration in the liquid. Any amount of additive reduces the mass flow of HF from a given size hole when compared to pure HF release."

In addition to the Quest MHF testing, research and testing on modifying the properties of HF was performed by Mobil and Phillips in the 1990s. The overall parametric MHF testing was successful in proving the effectiveness of the additive. This testing, which included small-scale tests, large-scale release tests, process and commercial demonstrations, and validated modeling proved that MHF was effective across the operating conditions of alkylation units and was an effective safety layer when used in combination with other mitigation systems.[8]

Conclusion

During the September 22, 2018 Refinery Committee meeting, and now repeated or implied in SCAQMD staff's February 1, 2019 presentation, the staff and their consultants provided an incomplete view of the historic HF, MHF, and water mitigation testing, which has been used by industry for decades to design and implement effective HF/MHF alkylation unit mitigation and safety systems. TORC's Alkylation Unit's mitigation and safety systems have been effective at preventing any offsite release of HF or MHF in 51 years of operation.

Dr. Koopman and Mr. Cornwell's presentations, and staff's summarization of them, were only "snapshots" of the overall testing. They excluded much of the expansive portfolio of scientific work performed on HF, MHF, and water mitigation. Their focus on the early Goldfish tests and partial MHF

---

[7] See District's "Addendum, Mitigated Negative Declaration, Mobil Modified Hydrogen Fluoride Conversion Project" (July 9, 1997), Appendix A, Quest Hazards Analysis, pp. 1-2 (June 16, 1996)

[8] The voluminous MHF testing, analysis, and modeling information has been previously disclosed to the SCAQMD by TORC as part of the PR 1410 process as Confidential Business Information/Trade Secrets (CBI) with permission from Honeywell/UOP and ExxonMobil Oil Corporation. It is TORC's position that Governing Board members can access this CBI, provided the CBI nature of this information is maintained. TORC's support for this position has also been provide to the SCAQMD.

tests presents a skewed version of history. By excluding the subsequent Hawk and Mobil and Phillips MHF testing, the story is incomplete. In fact, **the results of the Hawk tests**, not the preliminary Goldfish tests, **are widely used in industry today for designing mitigation systems.**

The results discussed during the September 22, 2018 Refinery Committee meeting and presented in the staff's February 1, 2019 presentation are merely a small glimpse into the HF, MHF, and water mitigation testing data available. Had the staff shared information on the totality of the research, testing, and analysis, they would have shown that water is up to 95% effective at removing HF during a release event, and that the layers of safety features work together to prevent a large or small release from getting offsite. Accordingly, it is imperative that the Governing Board consider the full scope of HF, MHF, and water mitigation data and experiments that prove MHF and the refineries' additional mitigation and safety systems are effectively designed and used to protect refinery workers and the community.

As TORC has previously presented to SCAQMD and the Refinery Committee, we are committed to further enhance our already robust, redundant, and layered mitigation and safety systems through an MOU process open to public participation.

Sincerely,

Steve Steach
Refinery Manager
Torrance Refining Company LLC

cc: Clerk of the Board
Wayne Nastri – Executive Officer, via email
Dr. Philip Fine – Deputy Executive Officer, via email